CITY OF FRANKLIN, TENNESSEE
ENGINEERING DEPARTMENT

SUPPLEMENTAL SPECIFICATIONS TO:

THE TENNESSEE DEPARTMENT OF TRANSPORTATION SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION; MARCH 1, 2006 as amended

SECTION 104
SCOPE OF WORK

104.04 – Maintenance of Traffic

In addition to the T.D.O.T. Standard Specifications for Road and Bridge Construction, March 1, 2006 (as amended) Standard Section 104.04, et al, the contractor shall be prohibited from closing any lanes during the peak hours or special days as established by the Engineer.

SECTION 712
TEMPORARY TRAFFIC CONTROL

712.01 – Description

In addition to the T.D.O.T. Standard Specifications for Road and Bridge Construction, March 1, 2006 (as amended) Standard Section 712.01, et al, the contractor shall provide a traffic control plan to the Engineer, or designee, for approval prior to the commencement of work in the Right-of-Way.

712.07 – Maintenance

In addition to the T.D.O.T. Standard Section 712.07, et al, the contractor shall operate and maintain the traffic signal installation from the time of initial mobilization to final acceptance. This temporary operation and maintenance responsibility consists of keeping the traffic signals in their normal fully operational state to the maximum extent possible. Contractors shall abide by the provisions of the City of Franklin Ordinance 2005-86 including permits, costs and fees.

Maximum limits for interruptions are as follows:

1. Power – Traffic Signal outages of up to two (2) hours with a minimum seventy-two (72) hours prior notice will be permitted. The contractor shall make provisions for manual traffic control during the outage with local Law Enforcement personnel. Power outages of longer duration shall have a temporary power supply (Generator or Temporary Electric Service Drop) provided and installed under the supervision of City of Franklin Traffic Signal/Electrical Inspector.
2. Detection – Detection shall be maintained and interruptions to detection shall be restored no more than seventy-two (72) hours from the time of disruption by one of the two following methods.
    a. Temporary induction loops of a configuration that matches those that were damaged, or those that are to complete the project. Placement may be

modified to fit new lane configurations. All loop installations shall be approved by the Engineer or designee.

SECTION 730
GENERAL REQUIREMENTS

730.01 – Description of Work.

All construction, materials, equipment, workmanship and installation procedures shall comply with the T.D.O.T. Standard Specifications for Road and Bridge Construction, March 1, 2006 (as amended) Section 730.01 et al, and with the current standards and specifications of the City of Franklin.

730.02 – Regulations and Code.

In addition to the T.D.O.T. Standard Section 730.02 et al, the contractor shall comply with all City of Franklin codes, permitting process and any requirements established by local utility agencies.

730.03 – Submittal Data Requirements.

In addition to the T.D.O.T. Standard Section 730.03 et al, the contractor shall supply prior to issuance of the "Notice to Proceed" a work schedule and traffic control plan for the City Engineer's review and approval.

730.04 – Mill Reports and Certifications.

730.05 – Working Drawings.

730.06 – Guarantee.

In addition to the T.D.O.T. Standard Section 730.06 et al, the contractor shall follow all applicable City of Franklin ordinances regarding ownership, operation and maintenance of the project installation.

730.07 – Training.

MATERIALS & INSTALLATION

730.08 – Excavating and Backfilling.

In addition to the T.D.O.T. Standard Section 730.08 et al, the contractor shall notify the Tennessee One Call System, Inc. at 1 (800) 351-1111 and each individual utility owner of his plan of operation in the area of the utilities. Prior to commencing work, the contractor shall contact all utility owners and request them to properly locate their respective utility

on the ground. This notification shall be given at minimum three (3) days prior to the commencement of operations around the utility.

All utility locations are approximate. It shall be the responsibility of the contractor to verify the location of all utilities prior to construction.

The contractor shall also perform trenching activities in accordance with the City of Franklin's Standard Detail 29 "Trench Details and Conduit Placement".

730.09 – Removing and Replacing Improvements.

In addition to the T.D.O.T. Standard Section 730.09 et al, the contractor shall coordinate with the City of Franklin for removal of the existing traffic control facilities upon activation of the new signal system.

730.10 – Foundations.

In addition to the T.D.O.T. Standard Section 730.10 et al, the contractor shall construct the controller cabinet foundation in accordance with City of Franklin standard drawing SD-30.

730.11 – Anchor Bolts.

730.12 – Pull Boxes and Manholes.

In addition to the T.D.O.T. Standard Section 730.12 et al, the contractor shall supply pull box covers as indicated with either the words "TRAFFIC SIGNALS" or "FIBER OPTIC" inscribed to the same specifications as directed by T.D.O.T. Standard Section 730.12.

The City of Franklin will specify the use of a manhole for use with a fiber optic communications system under certain applications. The manhole shall be consistent with the Hartford Concrete Products, Inc. 4' x 4' x 4' utility handhole or an approved equivalent.

730.13 – Transformer Base.

730.14 – Conduit.

In addition to the T.D.O.T. Standard Section 730.14; Materials et al, the contractor shall comply with the following City of Franklin Standards:

1. All conduits shall be Schedule 40 P.V.C. unless otherwise noted. Installation of R.G.C. will be permitted upon approval of the Engineer in upgrades to existing facilities. A AWG #14 shall be pulled as a trace/locate wire in any Fiber Optic Conduit run and spliced between boxes to form a continuous run. Any Fiber Optic Conduit shall be

terminated in a TDOT Type "B" pull box unless otherwise specified. Fiber Optic conduit shall have "Fiber Optic" warning tape installed a minimum of twelve (12) inches below finished grade.

2. For directional boring applications, High Density Poly-Ethylene (H.D.P.E.) conduit may be used. A AWG #14 shall be pulled as a trace/locate wire in any Fiber Optic Conduit run and spliced between boxes to form a continuous run. Any Fiber Optic Conduit shall be terminated in a TDOT Type "B" pull box unless otherwise specified.

All conduit installation shall utilize factory bends. Bends shall be "long sweep" specifically designed for electrically wiring applications. H.D.P.E. bends must maintain the minimum bend radius indicated by the manufacturer dependant on cabling (Fiber or Electrical) to be installed.

The contractor shall seal all open conduit entrance holes, with or without cables, with conduit Duct Seal putty. Where cables enter the conduit, the sealant shall be applied after installing the cable. These locations shall consist of conduit ends in pull boxes, cabinet bases and weatherheads.

All conduit installed shall include a "jet-line" for future conductor pulls and shall have a tracer wire for all Fiber Optic Conduit installations.

730.15 – Conductors.

In addition to the T.D.O.T. Standard Section 730.15 et al, the contractor shall install Stop Bar Detector loops that measure 6' x 45' with two turns of wire unless otherwise noted. Loops shall be centered in proposed lanes. Advance Detector loops shall measure 6' x 6' with three turns of wire unless otherwise noted. Loops shall be centered in proposed lanes.

730.16 – Cable.

730.17 – Wiring.

In addition to the T.D.O.T. Standard Section 730.17 et al, the contractor shall provide that loops and lead-in cable shall be continuous length; splices shall be permitted only in pull boxes or controller cabinets.

Label loops in cabinet in accordance with standard drawing T-SG-12. All wires shall be labeled in pull boxes on multi-lane approaches.

The contractor shall label all new and existing cables in the cabinet, pole/pedestal bases and pull boxes using the convention of drawing T-SG-12. Each wire shall be identified by a circular plastic tag, 1 3/8" diameter with preprinted lettering dies of minimum ¼ " height. Tags shall be permanently fastened to wire by means of nylon self clinching

straps. Marking shall indicate "GRD" for all ground and grounded neutral conductors. Companion circuit conductors shall be marked "CKT" followed by the designated characters as shown on the plans.

730.18 – Service Connection.

In addition to the T.D.O.T. Standard Section 730.18 et al, the contractor shall be responsible for providing electrical service to the site. The contractor shall obtain an electrical permit from the City of Franklin Codes Department prior to constructing the installation.

The contractor shall provide AC service installation to supply the following:

a. 100 amp main breaker with one (1) 50 amp breaker for the Traffic Signal Installation, three (3) 30 amp breakers, one each for the illuminated signs, safety lighting and a spare which may be used for project specific ITS infrastructure.
b. Each 30 amp breaker shall be labeled for its use. Locate photocell for illuminated street name signs and safety lighting at the service disconnect with a test/bypass switch.

Overhead Service connection shall be installed per the City of Franklin's Electrical Service Details (SD-26 A or B) for Traffic Signal Installation.

Underground Service connection shall be installed per the City of Franklin's Electrical Service Detail (SD-26 C) for Traffic Signal Installation. The Service Pedestal shall be a Milbank Model No. CP3B11110A22SL1 or approved equivalent.

730.19 – Sealant.

In addition to the T.D.O.T. Standard Section 730.19 et al, the contractor shall install the inductive loop detector without flexible tube or backer rod.

730.20 – Strand Cable.

730.21 – Bonding and Grounding.

730.22 – Field Test.

In addition to the T.D.O.T. Standard Section 730.22 et al, the contractor shall place the Traffic Signal in flash operation for a minimum of seven (7) days prior to the activation of the signal to normal operation.

730.23 – Inspection.

SIGNAL HEADS

730.24 – Signal Heads.

GENERAL REQUIREMENTS

In addition to the T.D.O.T. Standard Section 730.24 et al, each vehicle signal head shall be of the adjustable, colored lens, vertical type with the number and type of lights detailed herein and as shown on the plans or specified in the bid documents; shall provide a light indicator in one direction only; shall be capable of adjustment (without attachments) through 360 degrees about a vertical axis; and shall be mounted as shown on the plans or as specified by the Engineer. The arrangement of the lenses in the signal faces shall be in accordance with Section 4B-9 of the M.U.T.C.D. Five-section cluster signals shall be assembled with the red section centered above the bottom four sections, in a configuration referred to as "dog house". All circular and arrow indications shall use twelve (12) inch lenses. All new signal heads installed at any one intersection shall be of the same style and from the same manufacturer. Signal housings shall be painted Federal Yellow and shall meet or exceed Federal Specifications TTC-595 Gloss Yellow. Signal faces, doors and visors shall be painted Gloss Black. Pedestrian pushbuttons shall be painted black.

Louvers as specified, and the interior of signal visors, shall have one or more coats of primer followed by two coats of Lusterless Black Enamel meeting or exceeding Federal Specifications TT-E-489. Coating of these components shall be by an electrostatic painting process that bakes on the enamel. All factory enameled equipment and materials shall be examined for damaged paint after installation, and such damaged surfaces shall be repainted to the satisfaction of the Engineer. Factory applied enamel finish that remains in good condition and of appropriate color after installation will be acceptable.

Suspensions for span wire mounting of multi-faced signal heads and signal head clusters (such as a five-section signal head) shall include an approved swivel type balance adjuster for proper vertical alignment.

All signal heads must meet the minimum requirements for adjustable face Vehicle Traffic Control Signal Heads (VTCSH) as specified in ITE Publication No. ST-017B (1997).

MATERIAL

Signal heads shall be fabricated from cast aluminum. The signal housing shall be painted Federal Yellow. Door faces shall be painted Gloss Black. The door shall attach to the housing with stainless steel hinge pins, and be secured by stainless steel wing nuts. Visors shall be constructed of sheet aluminum and the exterior painted Gloss Black. Visors shall be of the cutaway tunnel type, secured to the front section of the door with four stainless steel machine screws that thread into tapped holes in the door.

OPTICAL UNITS

Each signal section shall consist of a housing, door, visor, and 300 mm diameter signal illumination unit. All vehicular signal indications shall be the light emitting diode (LED) type conforming to the minimum performance requirements as described herein for the illumination unit. An LED signal module shall be capable of replacing the optical unit of an existing vehicle traffic signal section.

1. Physical and Mechanical

LED traffic signal modules designed as retrofit replacements for existing signal lamps shall not require special tools for installation. Retrofit replacement LED signal modules shall fit into existing traffic signal housings built to the VTCSH "Vehicle Traffic Control Signal Heads" standard without modification to the housing.

Installation of a retrofit replacement LED signal module into an existing signal housing shall only require the removal of the existing optical unit components, i.e., lens, lamp module, and gaskets. The LED retrofit replacement shall not require the removal of the reflector and socket; shall be weather tight and fit securely in the housing.

2. Construction

The LED signal module shall be a single, self-contained device, not requiring on-site assembly for installation into an existing traffic signal housing. The power supply must be designed to fit and mount inside the traffic signal module. The external lens shall be smooth on the outside to prevent excessive dirt/dust buildup.

The assembly and manufacturing process for the LED signal assembly shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources as per ITE requirements.

3. Environmental Requirements

The LED signal module shall be rated for use in the ambient operating temperature range of -40ºC (-40ºF) to + 74ºC (+165ºF).

The LED signal module shall be protected against dust and moisture intrusion per the requirements of NEMA Standard 250-1991, for Type 4 enclosures to protect all internal LED, electronic, and electrical components.

The LED signal module lens shall be UV stabilized.

4. LED Signal Module Lens

Each module shall comprise of a smooth surfaced UV stabilized polycarbonate outer shell. LEDs shall be mounted on a polycarbonate positioning plate. A mechanical alignment and assembly mechanism shall ensure that each LED is retained in a pre-determined position.

Red and Green LED indications shall exceed minimum ITE LED luminosity values and meet the minimum luminous intensity values per the attached Table 1, Specifications for Spanwire Mounted Signals.

Supply independent lab test results showing the LED indications satisfy ITE Chapter 2a, VTCHS Part 2: Light Emitting Diode (LED) Vehicle Signal Modules, and attached Table 1, Specifications for Spanwire Mounted Signals. No optical lens shall be used in order to meet these visibility requirements.

Initial intensity of the LED indications shall meet or exceed 120% of the values in Table 1, Specifications for Spanwire Mounted Signals. This increased intensity shall be demonstrated on the independent lab reports, to ensure the intensity levels of the LED's meet the Table 1 values at the end of the warranty period.

5. Materials

The multiple LED light source should be the latest technology available on the market. Materials used for the lens and signal module construction shall conform to ASTM specifications for the materials where applicable. Enclosures containing either the power supply or electronic components of the signal module shall be made of UL94VO flame retardant materials.

6. Chromaticity

The measured chromaticity coordinates of LED signal modules shall conform to the chromaticity requirements of Section 8.04 and Figure 1 of the VTCSH standard.

7. Electrical

All wiring and terminal blocks shall meet the requirements of Section 13.02 of the VTCSH standard. Two secured, color-coded, 914 mm (36 in) long 600 V, 20 AWG minimum, jacketed wires, conforming to the National Electrical Code, rated for service at +105ºC, are to be provided for electrical connection.

The module shall operate on a 60 Hz AC line voltage ranging from 80 volts rms to 135 volts rms with less than 10% light intensity variation.

Nominal rated voltage for all measurements shall be 120 ± 3 volts rms. The circuitry shall prevent flickering over this voltage range. The module shall be ETL certified to meet applicable ITE standards (red and green).

8. LED Drive Circuitry (Power Supply)

The individual LED light sources shall be wired so that a catastrophic failure of one LED light source will result in the loss of only that one LED light source in the LED signal module. The power supply must be current regulated.

9. Electronic Noise

The LED signal and associated on-board circuitry must meet Federal Communications Commission (FCC) Title 47, SubPart B, Section 15 regulations concerning the emission of electronic noise.

10. Power Factor (PF)

The LED signal module shall provide a power factor of 0.90 or greater at 25ºC and at the nominal operating voltage.

11. AC Harmonics

Total harmonic distortion (THD), (current and voltage), induced into an ac power line by a signal module shall not exceed 20 percent, over the operating voltage range specified in Section 14 and within the ambient temperature range specified in Section 3.4.

12. Transient Voltage Protection

The signal module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.6, NEMA Standard TS-2, 1992.

13. Voltage Range

The LED signal module shall operate from a 60 ± 3 HZ ac line power over a voltage range from 80 Vac rms to 135 Vac rms. The current draw shall be sufficient to ensure compatibility and proper triggering and operation of load current switches and conflict monitors in signal controller units the procuring traffic authority customer has in use.

14. Signal Module Burn-in

All LED signal modules shall be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, in an ambient temperature of 60ºC (+140ºF).

15. Design Qualification Testing

Design Qualification testing shall be performed on new LED signal module designs, and when a major design change has been implemented on an existing design.

Testing shall be performed once every 5 years or when the module design or LED technology has been changed. Test data shall be retained by the manufacturer for a minimum period of 5 years.

16. Quality Assurance

LED signal modules shall be manufactured in accordance with a vendor quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance includes statistically controlled routine tests to ensure minimum performance levels of LED signal modules built to meet this specification.

QA process and test results documentation shall be kept on file for a minimum period of seven years.

17. Certificate of Compliance

Manufacturers shall provide a Certificate of Compliance to this specification for each shipment of LED signal modules to an end user. Each LED signal module shall be identified with a serial number. The manufacturer shall supply independent lab test results showing the red and green LED indications satisfy ITE Chapter 2a, VTCHS Part 2: Light Emitting Diode (LED) Vehicle Signal Modules, and attached Table 1, Specifications for Spanwire Mounted Signals. Initial intensity of the LED indications shall meet or exceed 120% of the values in Table 1, Specifications for Spanwire Mounted Signals. This increased intensity shall be demonstrated on the independent lab reports, to ensure the intensity levels of the LED's meet the Table 1 values at the end of the warranty period.

The manufacturer shall also participate in the ETL traffic control equipment certification program.

Table 1 - Specifications for Span Wire Mounted Signals

SPECIFICATION FOR RED SIGNALS

EXTENDED VIEW

	27.5	22.5	17.5	12.5	7.5	2.5	-2.5	-7.5	-12.5	-17.5	-22.5	-27.5
22.5			20			20	20			20		
17.5	16	20	22	22	22	22	22	22	22	22	20	16
12.5	16	22	34	44	48	50	50	48	44	34	22	16
7.5	16	38	89	145	202	226	226	202	145	89	38	16
2.5			77	141	251	339	339	251	141	77		
-2.5			77	141	251	339	339	251	141	77		
-7.5	16	38	89	145	202	226	226	202	145	89	38	16
-12.5	16	22	34	44	48	50	50	48	44	34	22	16
-17.5	16	20	22	22	22	22	22	22	22	22	20	16
-22.5			20			20	20			20		
-27.5			20			20	20			20		
-32.5			20			20	20			20		

SPECIFICATION FOR GREEN AND AMBER SIGNALS

EXTENDED VIEW

	27.5	22.5	17.5	12.5	7.5	2.5	-2.5	-7.5	-12.5	-17.5	-22.5	-27.5
22.5			40			40	40			40		
17.5	32	40	44	44	44	44	44	44	44	44	40	32
12.5	32	44	68	88	96	100	100	96	88	68	44	32
7.5	32	76	178	290	404	452	452	404	290	178	76	32
2.5			154	282	502	678	678	502	282	154		
-2.5			154	282	502	678	678	502	282	154		
-7.5	32	76	178	290	404	452	452	404	290	178	76	32
-12.5	32	44	68	88	96	100	100	96	88	68	44	32
-17.5	32	40	44	44	44	44	44	44	44	44	40	32
-22.5			40			40	40			40		
-27.5			40			40	40			40		
-32.5			40			40	40			40		

From TO-7057, rev.02/15/2002 of Texas DOT available on the web

NOTES

1 The ITE portion (highlighted in yellow) match ITE requirements for LED modules
2 Signal modules should be designed to meet these requirements at the end of the warranty period
3 Initial intensity of the signal modules should meet 120% of the above requirements
4 Independant laboratory test reports should be required to validate initial intensity

18. Warranty

Manufacturer will provide the following warranty provisions:

(1) Replacement or repair of an LED signal module that fails to function as intended due to workmanship or material defects within the first 60 months from the date of delivery.

(2) Replacement or repair of LED signal modules that exhibit luminous intensity of less than the minimum values specified in ITE specification VTCSH-Part-2 July 1998, and Table 1, Specifications for Span Wire Mounted Signals, within the first 60 months from the date of delivery.

EXTERIOR FINISH

All exterior parts facing the intended traffic movement shall be painted Gloss Black, unless otherwise noted.

The insides of visors and the entire surface of louvers or fins used in front of traffic signal lenses shall be finished a dull black as specified in these specifications (see Subsection - General Requirements).

SIGNAL HEAD MOUNTING AND MOUNTING BRACKETS

Signal heads shall have integrally cast serrations and shall be equipped with positive lock rings and fittings designed to prevent heads from turning due to external forces. Lock ring and connecting fittings shall be serrated contacts. Signals shall be provided with water-tight fittings using neoprene washers.

Bracket mounted signal heads, as shown on the plans, shall be supported by mounting brackets consisting of assemblies of 1 ½" standard pipe size. All members shall be either plumb or level, symmetrically arranged, and securely assembled. Construction shall be such that all conductors are concealed within poles and mounting assembly. Each slip fitter shall be secured to the pole with at least three stainless steel machine bolts.

DIRECTIONAL LOUVERS

Where shown on the plans, louvers shall be furnished and installed in the hoods of the signal head sections designated.

Directional louvers shall be so constructed as to have a snug fit in the signal hoods. The outside cylinder and vanes shall be constructed of a non-ferrous metal. Louvers shall be primed and then painted with two coats of dull black enamel as specified in these specifications (see Subsection 1.0 – General Requirements).

BACK PLATES

Backplates, where shown on the plans, shall be furnished and attached to the signal heads. All back plates shall be louvered on each of the four sides of the panel, and constructed of 0.051" minimum thickness vacuum-formed black polycarbonate material. In fabricating back plates, the inside vertical edges, adjacent to the signal head, shall be bent back forming mounting brackets for attaching to the signal. Back plates that are formed in two or more sections and bolted together, thus permitting installation after signal heads are in place, will be acceptable. Back plates shall have a dull black appearance.

WIRING

Signal head leads shall be No. 18 AWG stranded with 2/64", 105 degrees C Thermoplastic insulation. A separate white (common) lead shall be wired to each socket shell; and a colored lead, corresponding to the lens color, shall be wired to each socket terminal. Leads shall be of sufficient length to allow connection to the terminal block specified herein. Each complete signal head shall be provided with a 4-point terminal block, properly mounted in a signal section. Stud type terminal blocks shall have not less than 1/4 edge clearance to any portion of the stud. Exterior wiring shall have a 360 degree drip loop in advance of entering the head.

PEDESTRIAN SIGNALS

When shown on the plans, pedestrian signals shall conform to the following:

General Requirements

Pedestrian LED traffic signal modules shall be designed as a retrofit replacement for the message bearing surface of a 16” × 16” pedestrian traffic signal housing built to the PTCSI Standard, or a two-section 12” × 12” pedestrian traffic signal housing built to the PTCSI Standard. The message-bearing surface of the module shall be supplied with the solid “HAND” and “MAN” symbols that comply with the PTCSI standard for this symbol for a message-bearing surface of the size specified. This message-bearing surface shall be designed so that it can be removed from the sealed unit for replacement without further damage to the module.

1. **Physical and Mechanical**

   LED pedestrian signal modules shall be designed as retrofit replacements for the existing pedestrian signals.
   LED pedestrian signal modules shall not require special tools for installation.

   LED pedestrian signal modules shall fit into the existing traffic housings built to the VTCSH Standard without any modification to the housing.

LED pedestrian signal modules shall be weather tight, fit securely in the housing and shall connect directly to existing electrical wiring.

Installation of a replacement LED module into the existing pedestrian housing shall only require the removal of the existing optical unit components, i.e., lens, lamp, gaskets, and reflector.

Each retrofit shall include all necessary components to complete conversion including a one-piece gasket.

Each pedestrian module shall have a sticker attached stating compliance to the ITE Standard for color and size of symbols.

2. Pedestrian Lenses

The lens of the LED pedestrian signal modules shall be field replaceable.

The lens of the LED pedestrian signal modules shall be polycarbonate UV stabilized and a minimum of 3/16 ” thick.

The exterior of the lens of the LED pedestrian signal module shall be smooth and frosted to reduce sun phantom.

3. Construction

The LED pedestrian signal module shall be a single, self-contained device, not requiring on-site assembly for installation into the existing traffic signal housing

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All Portland Orange LEDs shall be “AlInGaP” technology or equal, and rated for 100,000 hours or more at 25ºC and 20 mA. “ALGaAS ” technology is not acceptable. All white LEDs shall be "InGaN" Technology or equal, and rated for 100,000 hours or more at 20^{o}C and 10mA.

All internal LED and electronic components shall be adequately supported to withstand mechanical shock and vibration from high winds and other sources.

The signal module shall be made of UL94VO flame-retardant materials. The lens is excluded from this requirement.

Each individual LED traffic module shall be identified for warranty purposes with the manufacturer’s trade name, serial number and operating characteristics, i.e., rated voltage, power consumption, and volt-ampere.

4. Environmental Requirements

The LED pedestrian signal modules shall be rated for use in the ambient operating temperature range of -40ºC to +60ºC (-40ºF to +140ºF).

The LED pedestrian signal modules, when properly installed with gasket, shall be protected against dust and moisture intrusion per requirements of NEMA Standard 250-1991, sections 4.7.2.1 and 4.7.3.2, for type 4 enclosures to protect all internal LED, electronic, and electrical components.

5. Luminous Intensity

Pedestrian LED signal modules shall be designed so, that when operated over the specified ambient temperature and voltage range, the signal shall attract the attention of, and be readable to, a viewer (both day and night) at all distances from 3 m to the full width of the area to be crossed. The luminous intensity of the LED pedestrian signal module shall not vary more than ± 10 % for voltage range of 80 VAC to 135 VAC.

6. Chromacity

The measured chromaticity coordinates of the LED signal modules shall conform to the chromaticity requirements of Section 5.3 and Figure C of the PTCSI standard.

7. Electrical

The secured, color coded, 914 mm (36 in) long, 600V, 20 AWG minimum, jacketed wires, conforming to the National Electrical Code, rated for service at +105ºC, ½ inch stripped and tinned are to be provided for electrical connection.

The LED pedestrian signal module shall operate from a 60 ±3 Hz AC line over a voltage range of 80 VAC to 135 VAC. Rated voltage for all measurements shall be 120 ±3 volts rms.

The LED circuitry shall prevent perceptible flicker over the voltage range specified above.

The LED pedestrian signal module circuitry shall include voltage surge protection against high-repetition noise transients and low-repetition noise transients as stated in Section 2.1.6, NEMA Standard TS-2, 1992.
Catastrophic failure of one LED light source shall not result in the loss of more than the light from that one LED.

The LED pedestrian module shall be operationally compatible with the currently used controller assemblies. The LED pedestrian module shall be operationally compatible with conflict monitors.

The LED pedestrian module including its circuitry must meet Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of noise.

The LED pedestrian module shall provide a power factor of .90 or greater over the operating voltage range and temperature range specified above.

Total harmonic distortion induced into an AC power line by an LED pedestrian module shall not exceed 20% over the operating voltage range and temperature range specified above.

8. Quality Assurance

LED pedestrian modules shall be manufactured in accordance with a Vendor quality assurance (QA) program including both design and production quality assurance. All QA process and test results documentation described below shall be kept on file for a minimum of seven years.

9. Production Quality Assurance

The following Production Quality Assurance tests shall be performed on each new LED signal module prior to shipment. Failure to meet requirements of any tests shall be cause for rejection.

a. Pedestrian Module Burn-In – All LED signal modules (or boards) shall be energized for a minimum of 24 hours, at 100 percent duty cycle, in an ambient temperature of 60ºC (140ºF).
b. After burn-in, all LED pedestrian modules shall be tested for power factor and shall meet the requirements defined in this specification.
c. After burn-in, all LED pedestrian modules shall be measured for current flow in amperes. The measured current values shall not exceed 110% of the design qualification measurements (described in the next section).
d. All LED pedestrian modules shall be visually inspected for any exterior physical damage or assembly anomalies. Careful attention shall be paid to the surface of the lens to ensure there are no scratches, cracks, chips, discoloration, or other defects.

10. Design Qualification Testing

Design Qualification testing described below shall be completed documented and submitted with the equipment quotation. All Design Qualification testing shall be performed after a burn-in (module energized for a minimum of 24 hours, at 100 percent duty cycle, in an ambient temperature of +60ºC (+140ºF).

a. The LED pedestrian modules shall be measured for wattage by an independent testing laboratory.
b. The LED pedestrian module shall be measured for chromaticity per the requirements defined in this specification at an ambient temperature of +25ºC (+77ºF) by an independent testing laboratory.
c. The LED pedestrian modules shall be measured for power factor per the requirements defined in this specification by an independent testing laboratory.
d. The LED modules shall be measured for total harmonic distortion per the requirements defined in this specification by an independent testing laboratory.
e. The LED pedestrian modules shall be tested for electronic noise per the requirements defined in this specification with reference to Class A emission limits referenced FCC Title 47 Subpart B, Section 15 by an independent testing laboratory.
f. The LED pedestrian modules shall be tested for transient immunity (e.g. early electronic component mortality failures, component reliability problems) using NEMA Standard TS 2-1992 by an independent testing laboratory.
g. Mechanical vibration testing shall be performed on the LED pedestrian modules, by an independent testing laboratory, in accordance with MIL-STD-883, Test Method 2007, using three 4 minute cycles along each x, y, z axis, at a force of 2.5 Gs, with a frequency sweep from 2 Hz to 120 Hz. The loosening of the lens, of any internal components, or other physical damage shall be cause for rejection.
h. Temperature cycling shall be performed on the LED pedestrian modules, by an independent testing laboratory, in accordance with MIL-STD-883, Test Method 1010. Using the temperature range of -40ºC to +60ºC (-40ºF to +60ºF), twenty cycles (minimum) with a thirty-minute transfer time between temperature extremes and with a thirty minute dwell time at each extreme shall be performed. Modules under test shall not be energized. Modules that fail to function properly or show evidence of cracking of the lens or housing shall be rejected.

NOTE: With respect to design changes, if the construction of the modules has not been modified, documentation of testing described in items e, g, and h on older models is acceptable at time of bid. Updated documentation will be required prior to first shipment.

11. Manufacturer Qualification

a. Manufacturer/Distributor/Vendor must have experience with furnishing

b. LED lighting for the installation of at least 5,000 LED traffic signals on any one project.

12. Warranty

The unit shall be repaired or replaced by the contractor if it exhibits a failure due to workmanship or material defect within the first 60 months of delivery.

a. The unit shall be repaired or replaced by the contractor if it exhibits a failure due to workmanship or material defect within 60 months of delivery.
b. The unit shall be repaired or replaced if the intensity level falls below 50% of the original values within 36 months of delivery.

Any signal heads when visible to drivers, but not operational, shall be completely covered.

CONTROLLERS - GENERAL

730.25 – Controllers.
In addition to the T.D.O.T. Standard Section 730.25 et al, the contractor shall furnish and install a traffic signal controller cabinet to be determined by the City of Franklin.

a. Construct the controller cabinet and foundation in accordance with TDOT Type IV controller cabinet.
b. Construct the controller cabinet and foundation in accordance with City of Franklin Special Detail # 30. A Type IV cabinet that incorporates an uninterruptible power supply (U.P.S.). The cabinet shall be an Eagle ELS1014 size "P-UPS" base mounted cabinet with integrated UPS compartment. The UPS system shall be a Clary SPD2000 PD-N for rack mounting.

The contractor shall also at a minimum of thirty (30) days prior to turn on, contact the City of Franklin Traffic Operations Center (615) 550-6672 to arrange the delivery of the new controller for programming by the city. Upon city installation of the timings in the controller, the contractor shall retrieve the controller and install it at the intersection.

730.26 – Traffic Actuated Controllers.

In addition to the T.D.O.T. Standard Section 730.26 et al, the contractor shall provide a signal controller and cabinet equivalent to an 8-Phased Eagle EPAC 300 Series with coordination. The cabinet shall provide for a minimum of sixteen (16) signal circuits and load bay positions.

730.27 – Auxiliary Equipment for Traffic Actuated Controllers

1. In addition to the T.D.O.T. Standard Section 730.27 et al, the contractor shall provide a signal cabinet and auxiliary equipment to allow for full eight (8) phase operation irrespective of intersection design.

2. The contractor shall install a dual GPS/infrared Opticom emergency vehicle priority control system in conjunction with the traffic signal installation. Priority control shall be provided on the applicable approaches of the intersection as indicated on the plans. Intersection detection equipment will consist of a GPS receiver and radio transceiver along with an infrared detector both connected to a multimode phase selector located in the intersection controller cabinet. The GPS radio unit receives the data-encoded radio signal from the GPS radio equipped vehicle and transmits the decoded information through detector cable to the multimode phase selector for processing. The intersection radios also communicate to vehicles and other intersection radios at distances of up to at least 2,500 feet (762m) with no obstructions. The infrared detector receives the data-encoded infrared signal from the infrared equipped vehicle and transmits information through detector cable designed to convert infrared light energy at the proper wavelength into analog voltage signals that can be evaluated and decoded by the multimode phase selector.

   The multimode phase selector shall be installed in the same card rack as the vehicle detectors. The multimode phase selector shall be capable of receiving data encoded signals from either or both infrared and GPS radio detection equipment and combine the detection signals into a single set of tracked vehicles requesting priority activation. The multimode phase selector will process the vehicle information to ensure that the vehicle is (1) in a predefined approach corridor, (2) heading toward the intersection, (3) requesting priority, and (4) within user-settable range. The multimode phase selector shall treat the combined, single set of tracked calls with first come first served priority methodology within a given priority level. Arbitration between infrared signal intensity and GPS radio distance/ETA shall be first come first served methodology based on time of detection as each equipped vehicle reaches its programmed threshold.

   When these conditions are met, the phase selector shall generate a priority control request to the traffic controller for the approaching priority vehicle. If the approaching GPS radio preemption equipped vehicle has an active turn signal, the approach intersection shall relay the priority request to the next nearest in-range intersection in the direction of the approaching vehicle's turn signal. The output of the phase selector may also be varied depending on the state of the approaching vehicle's turn signal.

   To ensure priority control system integrity, operation and compatibility, all components shall be from the same manufacturer. The system shall offer compatibility with most signal controllers, e.g. NEMA (National Electrical Manufacturers Association) 170/2070 controllers. The system can be interfaced with most globally available controllers using the controller's preemption inputs. RS-232, USB and Ethernet interfaces shall be provided to allow management by on-site interface software and central software.

   Detector cable model 138 shall be provided by the contractor as required for infrared detector connection to the multimode phase selector. The cable provided by the contractor to connect the GPS/radio unit to the multimode phase selector shall be a shielded 10-conductor data cable; the use of coax cable is not permitted.

FLASHING SCHOOL SIGNALS

730.28 – Flashing School Signals.

In addition to the T.D.O.T. Standard Section 730.28 et al, the signal heads used for school or warning flashers shall conform to Section 730.24 of the T.D.O.T standards and these supplemental specifications.

DETECTORS

730.29 – Detectors.

In addition to the T.D.O.T. Standard Section 730.29 et al, the contractor shall provide loop detector amplifiers that are four channel for card-rack placement. Each loop shall have its own distinct circuit (channel). Card rack shall be wired to accommodate detector amplifiers and both GPS/radio and infrared Opticom multimode phase selector units.

730.30 – Coordination.

In addition to the T.D.O.T. Standard Section 730.30 et al, the contractor shall supply all appurtenances required to have a complete and operating interconnected system traffic signal if required. For the City of Franklin compatibility the equipment shall be an Eagle EPAC 3108-M52 A Fiber Connections Inc. "Gator Patch" Model # GP20L006FRB-xx-1 fiber optic distribution panel and drop cable shall be installed in the cabinet. (xx is cable length to splice pull box in meters)

730.31 – Time Base Coordination Units

TRAFFIC SIGNAL SUPPORTS

730.32 – Cantilever Signal Supports.

In addition to the T.D.O.T. Standard Section 730.32 et al, the contractor and/or the pole fabricator shall determine the size and design of all steel signal support poles and foundations. Shop drawings for the proposed poles shall be submitted to the City of Franklin Engineering Department for review and approval. The steel supports shall be finished by the manufacturer in a black gloss color and shall be touched up as needed by the contractor.

730.33 – Steel Strain Poles.

In addition to the T.D.O.T. Standard Section 730.33 et al, the steel supports shall be finished by the manufacturer in a black gloss color and shall be touched up as needed by the contractor.

730.34 – Pedestal Support Signal Poles.

In addition to the T.D.O.T. Standard Section 730.34 et al, the steel supports shall be finished by the manufacturer in a black gloss color and shall be touched up as needed by the contractor.

730.35 – Wooden Signal Support Poles.

730.36 – Pole Location.

In addition to the T.D.O.T. Standard Section 730.34 et al, the proposed locations of signal support poles and controller as shown on these plans are approximate. Some field adjustment may be required in order to avoid conflict with either underground, above ground, or overhead utilities. The contractor shall be responsible for determining and staking the optimum locations for the poles/controller and for receiving approval from the City of Franklin Engineering Department before installation begins. Proper roadside clear zones shall be observed.

COMPENSATION

730.37 – Method of Measurement.

In addition to the T.D.O.T. Standard Section 730.37 et al, vehicle loop amplifier shall conform to Section 730.29 of the T.D.O.T standards and these supplemental specifications.

Utility companies will be responsible for the relocation and/or removal of their poles and equipment. The poles and equipment to be removed by the Contractor have been generally noted on the Plans; however, it is the intent of these Specifications to have the Contractor remove any traffic control related equipment that is in conflict with the proposed equipment and deliver to the City of Franklin Streets Department facility.

The City of Franklin
Streets Department
108 Southeast Parkway
Franklin, TN 37064
Office: (615) 791-3254
Fax: (615) 791-3200

All new or temporary signals shall be removed and stockpiled in such a manner that the removed equipment will not be damaged. Poles shall be removed complete and undamaged. The pole shall be cleaned of any concrete foundation material. Any damage

due to negligence on the part of the contractor because of lack of proper care of equipment shall be cause for the contractor to replace in kind. The cost of such replacement shall be borne fully by the contractor without extra compensation. All such removed and salvageable equipment is now and shall remain the property of the City of Franklin.

730.38 – Basis of Payment.

INTERNALLY ILLUMINATED STREET NAME SIGNS

The LED internally illuminated signs are not brand specific but should comply with the materials standards outlined in the Materials, Mechanical, Electrical, and Optical Performance ratings of this specification. This specification shall govern for LED (light emitting diode) internally illuminated street name signs attached to traffic pole shafts and or mast arms. All materials used in fabrication shall be new and of good quality.

SNS - 1.0 MECHANICAL SPECIFICATIONS

SNS - 1.1 Sign Dimensions:

The LED internally illuminated street name sign shall be capable of being constructed in standard widths from 12 inches up to 9 feet in length, according to the legend.

The height of the signs shall be 22 inches to accommodate 12-inch upper case letters and 2.5-inch clearances from the vertical sides. Street name legend shall be mixed upper and lower case letters, with a superscripted extension.

The sign should be a maximum depth of 1.5 inches for single sided signs.

SNS - 1.2 Environmental Requirements:

The sign fixture shall be designed and constructed to prevent deformation or failure when subjected to 121 km/h (75 mph) wind loads in conformance with the requirements of the AASHTO I publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaries and Traffic Signals", and all associated updated amendments

The sign fixture should be able to withstand and operate at temperature extremes of -40deg F to 125deg F.

The sign fixture should be able to withstand salt spray and moisture.

SNS - 2.0 MATERIALS

SNS - 2.1 Materials:

All materials furnished by the Manufacturer/Vendor/Contractor shall be in accordance with the NEC.

Signs shall have a single side message as shown on the design sheet. The text message should be bright white letters etched and paint filled into the acrylic. The background shall be a green high intensity retro reflective film of diamond grade VIP material by 3M Company, or approved equal.

The Manufacturer/Vendor shall supply shop drawing submittals on the fixtures, sign, sign message and mounting hardware. Where the Manufacturer/Vendor has not previously supplied the item to the City of Franklin or its Contractors, that Supplier shall provide a full-size physical prototype of all equipment to the City for inspection, review and approval.

The materials used in the sign shall be the following or their equivalent: Protection face: 3M 1160 Series sheeting with ultra violet protection, and abrasive and mar resistant. Sign face: Cast acrylic 9mm. Sign back: Extruded acrylic 3mm. Aluminum back plate: Utility aluminum 1/8". Top and bottom extrusion: Extruded aluminum alloy 6063 with baked-on gloss black enamel. End caps: Utility aluminum gauge 12. Mounting brackets: Utility aluminum 1/8". All fasteners shall be stainless steel. Gaskets: Polyethylene.

SNS - 2.2 Housing:

The sign frame/housing and backing shall be formed and manufactured out of extruded aluminum alloy 6063 with a minimum tensile strength of 25,000 ksi.

The sign frame and backing shall be finished with a baked-on enamel process in gloss black. The sign frame and housing shall incorporate stainless steel fasteners to secure the sign in the closed position.

The end caps shall have an internal gasket installed to seal against the top and bottom extrusions.

SNS - 2.3 Sign Panels:

The sign panel shall be slide mounted in the frame and accessible by removal and reinstallation of the top frame or by a door with continuous hinging along the bottom of the front panel frame.

The entire surface of the sign panel shall be evenly illuminated so that the surface of a 1ft x 1ft section of the sign has a light output of a minimum of 50 nits with a maximum degradation to 15 nits after 5 years.

The protection film shall be a clear transparent overlay of high impact UV resistant plastic/acrylic material able to withstand 5 years of <400nm UV light. All surfaces shall be free of blemishes in the plastics or coating that might impair the service of detract from the general appearance and color matching of the sign.

SNS - 2.4 Hardware:

The sign shall be rigid-mounted to a pole shaft or mast arm. The method of mounting shall be by banding. Unless otherwise shown on the plans or required in this specification, all fasteners and screws in or on the fixture shall be stainless steel type 302 or 305, brass or aluminum. All steel nuts, bolts, and hardware for sign attachment shall be stainless steel type 302 or 305.

The plans are to show the location on the mast arms for the clamp-on street signs, when required, as well the location and details for the wire entrance. Offset mounting brackets with clamps and adapters shall be attached at two-foot spacing on the back side panel for use of Band-It material to rigidly mount the sign to the mast arm. The sign bracket itself shall clamp the top and bottom frame of the sign. The adapters shall swivel around the mid-height level of the sign, and be lockable to allow for leveling of the sign.

All wiring connections within the sign fixture shall terminate through an U.L. approved junction box.

All conductors inside the sign fixture and on the load side of the power source shall be U.L. listed appliance material (no smaller than #14 AWG) stranded copper wire with thermoplastic insulation.

SNS – 3.0 ELECTRICAL

SNS - 3.1 Light Source:

The LED internally illuminated street name sign light modules shall be composed of white LEDs with a minimum viewing angle 110º mounted on rugged metal boards consuming no more than 1.5 Watts per linear foot, with a thermal resistance path from the LED pin to the most external surface of the aluminum extrusion of no more than 20ºC/Watt at an ambient temperature of 25ºC to reduce wear and tear on the individual LEDs and to extend useable lifetime. The LED light modules should be thermally coupled directly to the aluminum extrusion using thermal adhesive transfer tape. The LED light modules should be mounted to project light into the border of an optically coupled light panel. The light panel redirects the light to create a uniform illuminated plane with minimum candelas per meter squared of 50nits at initial turn on and no less than 15nits after 5 years. For each linear foot of sign, a combination of one top and one bottom LED Light module shall be used. Each LED Light module board shall be replaceable by disassembly of the sign. All interconnections between LED light modules should

be hard solder connections to eliminate thermal fatigue and micro cracking associated with power cycling.

SNS - 3.2 Electrical Power Source/Power Supply:

The sign shall be powered by a 120-vac to 12Vdc Class II UL approved grid utility source. The power source should be capable of performing as one power supply to light all signs at the intersection, with a maximum voltage drop of 3% at any individual sign. This type of power source should have four (4) independent channels with a maximum load per channel of 60Watts or 240Watts total. All power sources should be enclosed in a NEMA 3R approved box or in the traffic signal cabinets.

SNS - 3.3 Auto On/Off Switch:

An automatic ON/OFF twilight sensor switch located either before the sign power supply or on the initial LED light module shall control the time the LED's should be on or off.

In the event that the sensor switch is to be located on the initial LED module, it should be mounted as the first electrical contact point in the sign and should be mounted directly adjacent to the first LED light module. The twilight sensor shall also be optically coupled to the light panel. The twilight sensor shall be capable of handling a maximum power of the rated load of the sign to allow for ample guard banding to power up to a 10 ft long sign. The twilight sensor should be blind to light ranges from 285nm to 700nm and should not be false triggered by direct coupling with LED light modules.

The maximum power per foot of sign shall not exceed 1.5watts maximum, except if a twilight sensor is used then the max power for the first 1" of the sign shall not exceed 2.5 Watts.

SNS - 3.4 Surge/Induced Lightning Protection:

A protection circuit can be included to provide up to 1000 Watts of protection for 1 millisecond pulse to protect against transients induced by lightning and inductive load switching. The protection device should have a response time of 1 X 10^{-12} seconds so it is also effective in protecting against electrostatic discharge and NEMP in the case of improper handling of the sign.

The protection circuit should be integral to the first LED Light module in the street name sign.

SNS - 3.5 Back Up Power:

Auxiliary back up power systems shall not be required with these signs.

SNS - 4.0 OPTICAL PERFORMANCE

SNS - 4.1 Light Output:

The sign shall be able to produce 50 nits at initial installation, or 15nits after a period of 5 years. Measurements of light output and compliance with safety requirements can be made using a chromo meter.

SNS - 5.0 WARRANTY, MAINTENANCE, AND SUPPORT

The contractor shall obtain and assign to the City where the sign is installed all manufacturers' guarantees or warranties which are normally provided as customary trade practice for items and materials incorporated into the work. In the absence of a manufacturer's guarantee, the Contractor shall warrant that mechanical and electrical equipment and material incorporated into the work are free from any defects or imperfections in workmanship and material for a period of one (1) year after final acceptance of the project. The Contractor shall be responsible for repairing any malfunction or defect in any such equipment or material, which develops during the one (1) year period.

PAVEMENT MARKINGS

PM - 1.0 Description.

In addition to the T.D.O.T. Standard Section 716 et al, all stop lines and pavement arrows shall be a preformed pliant polymer material or thermoplastic material. Stop lines shall be 24 inches wide.

New Pavement markings shall be of a preformed pliant polymer material or thermoplastic material and applied to areas not already marked. In transition areas, new pavement markings shall be extended 20 feet into existing pavement markings. Existing pavement markings shall be reapplied as needed.

PM - 2.0 Materials.

Material, equipment, and hardware furnished under this section must be pre-approved by the Engineer.

PM - 3.0 Construction Methods.

In accordance with the T.D.O.T. Standard Section 712 et al.

PM - 4.0 Method of Measurement.

In accordance with the T.D.O.T. Standard Section 712 et al.

FIBER-OPTIC CABLE

All construction, materials, equipment, workmanship and installation procedures shall comply with the T.D.O.T. Standard Specifications for Road and Bridge Construction, March 1, 2006 (as amended) Section 730.01 et al, and with these current standards and specifications of the City of Franklin.

FIBER OPTIC CABLE (OSP)

All outside plant trunk cables used in the project shall be stranded loose tube design. Drop cables shall be central core or stranded loose tube design. The cable configurations shall be dictated by the particular communication path, data rate, & distance of the optical path.

Cable configurations required for this project are displayed in the plans.

FOC - 1.1 FIBER OPTIC CABLE (OSP)

FOC - 1.1 General Considerations

The cable shall meet all requirements stated in this specification. The cable shall be a listed product of the United States Department of Agriculture Rural Utilities Services (RUS) 7 CFR1755.900 and the ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1992.

The cable shall be new, unused, and of current design and manufacture.

FOC - 1.2 Fiber Characteristics

All fibers in the cable must be usable fibers and meet required specifications.

Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be matched clad design.

SINGLE-MODE: The single-mode fiber utilized in the cable specified herein shall conform to the following specifications:

- Typical Core Diameter: 8.3 µm.
- Cladding Diameter: 125.0 ± 1.0 µm.
- Core-to-Cladding Offset: ≤ 0.8 µm.

- Cladding Non-Circularity: ≤ 1.0%. Defined as: [1-(min. cladding dia. ÷ max. cladding dia.)] X 100
- Coating Diameter: 245 ± 10 µm.
- Colored Fiber Diameter: nominal 250 µm.
- Attenuation Uniformity- No point discontinuity greater than 0.10 dB at either 1310 nm or 1550 nm.
- Attenuation at the Water Peak- The attenuation at 1383 ± 3 nm shall not exceed 2.1 dB/km.
- Cutoff Wavelength- The cabled fiber cutoff wavelength (λ_{ccf}) shall be < 1250 nm.
- Mode-Field Diameter: 9.30 ± 0.50 µm at 1310 nm 10.50 ± 1.00 µm at 1550 nm
- Zero Dispersion Wavelength (λ_o)- 1301.5 nm ≤ λ_o ≤ 1321.5 nm.
- Zero Dispersion Slope (S_o)- ≤ 0.092 ps/(nm²×km).
- Polarization Mode Dispersion ≤ 0.5 ps/sq.rt. km

The coating shall be a dual layered, UV cured acrylate applied by the fiber manufacturer.

The coating shall be mechanically strippable without damaging the fiber.

FOC - 1.3 Fiber Specification Parameters

Required Fiber Grade - Maximum Individual Fiber Attenuation for single-mode fibers shall be 0.40dB/km @ 1310nm, 0.30dB/km @ 1550.

The maximum dispersion shall be ≤ 3.2 ps/(nm_km) from 1285 nm through 1330 nm and shall be ≤ 18 ps/(nm_km) at 1550 nm.

FOC - 1.4 Specifications for Outdoor Trunk Cables

Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm.

Each buffer tube shall contain up to 12 fibers.

The fibers shall not adhere to the inside of the buffer tube.

Each fiber shall be distinguishable from others by means of color coding in accordance with EIA/TIA-598-A, "Optical Fiber Cable Color Coding." The ink for coloring fibers shall be UV cured, no thermal inks shall be used in the coloring process.

Buffer tubes containing fibers shall also be color coded with distinct and recognizable colors in accordance with EIA/TIA- 598, "Optical Fiber Cable Color Coding."

- Buffer tube colored stripes shall be inlaid in the tube by means of co-extrusion when required. The nominal stripe width shall be 1 mm.

- For dual layer buffer tube construction cables, standard colors are used for tubes 1 through 12 and stripes are used to denote tubes 13 through 24. The color sequence applies to tubes containing fibers only, and shall begin with the first tube. If fillers are required, they shall be placed in the inner layer of the cable. The tube color sequence shall start from the inside layer and progress outward.

In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together.

The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrink back requirements of 7 CFR 1755.900.

Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed.

The central anti-buckling member shall consist of a glass reinforced plastic rod. The purpose of the central member is to prevent buckling of the cable.

Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "SZ", stranding process. Water blocking yarn(s) shall be applied longitudinally along the central member during stranding.

For single layer cables, a water blocking tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter. Dual layer cables shall be water blocked in a similar fashion.

Two polyester yarn binders shall be applied contra helically with sufficient tension to secure the buffer tube layer to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking and dielectric with low shrinkage.

The cable shall contain at least one ripcord under the sheath for easy sheath removal.

Tensile strength shall be provided by high tensile strength aramid yarns and/or fiberglass yarns.

The high tensile strength aramid yarns and/or fiberglass yarns shall be helically stranded evenly around the cable core.

The cable shall be sheathed with medium density polyethylene. The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The jacket or sheath shall be free of holes, splits, and blisters.

The cable jacket shall contain no metal elements and shall be of a consistent thickness.

The cable jacket shall be marked with "'Manufacturer' Optical Cable," sequential foot markings, year of manufacture, fiber count and fiber types, EX (72f, 36 sum, and 36 mm 62.5/125). The actual length of the cable shall be within -0±1% of the length markings. The marking shall be in contrasting color to the cable jacket. The height of the marking shall be approximately 2.5 mm.

The maximum pulling tension shall be 2700 N (608 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

The shipping, storage, and operating temperature range of the cable shall be -40degreeC to ±70degreeC. The installation temperature range of the cable shall be -30degreeC to ±70degreeC.

FOC - 1.5 Specifications for Drop Cable (to Controllers, VMS, Camera locations, etc.).

The City of Franklin specifies that the Fiber Connections Inc. "Gator Patch ITS Drop Cable" Model # GP20L006FRB-xx-1 shall be used in each location. (xx is cable length to splice pull box plus additional twenty (20) feet slack for splicing in meters). This unit is the fiber termination panel to be mounted in the cabinet AND the attached drop cable is run to the trunk cable splice pull box where a mid-span splice will be made.
http://www.fiberc.com/PDFFiles/GatorPatchITSDropCable.pdf

FOC - 1.6 General Cable Performance Specifications for OSP cables

When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components," the change in attenuation at extreme operational temperatures (-40degreeC to ±70degreeC) shall not exceed 0.2 dB/km at 1550 nm for single-mode fiber and 0.5dB/km at 1300 nm for multimode fiber.

When tested in accordance with FOTP-82, "Fluid Penetration Test for Filled Fiber Optic Cable." a one meter length of unaged cable shall withstand a one meter static head or equivalent continuous pressure of water for one hour without leakage through the open cable end.

When tested in accordance with FOTP-81, "Compound Flow (Drip) Test for Filled Fiber Optic Cable", the cable shall exhibit no flow (drip or leak) of filling or flooding compound at 65degreeC.

When tested in accordance with FOTP-41, "Compressive Loading Resistance of Fiber Optic Cables, the cable shall withstand a minimum compressive load of 220 N/cm (125 lbf/in) applied uniformly over the length of sample. The load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes. The change in attenuation shall not exceed 0.4 dB during loading and 0.2 dB after loading at 1550 nm for single-mode.

When tested in accordance with FOTP-104, "Fiber Optic Cable Cyclic Flexing Test," the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The change in attenuation shall not exceed 0.1 dB at 1550 nm for single-mode fiber.

When tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies," the cable shall withstand 25 impact cycles. The change in attenuation shall not exceed 0.2 dB at 1550 nm for single-mode fiber.

When tested in accordance with FOTP-33, "Fiber Optic Cable Tensile Loading and Bending Test," using a maximum mandrel and sheave diameter of 560 mm, the cable shall withstand a tensile load of 2700 N (608 lbf). The change in attenuation shall not exceed 0.2 dB during loading and 0.1dB after loading at 1550 nm for single- mode.

When tested in accordance with FOTP-85, "Fiber Optic Cable Twist Test," a length of cable no greater than 4 meters will withstand 10 cycles of mechanical twisting. The change in attenuation shall not exceed 0.1 dB at 1550 nm for single-mode fiber.

When tested in accordance with FOTP-37, "Low or High Temperature Bend Test for Fiber Optic Cable", the cable shall withstand four full turns around a mandrel of 10 times the cable diameter after conditioning for four hours at test temperatures of -30degreeC and +60degreeC. Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears or other openings. Optical continuity shall be maintained throughout the test.

FOC - 1.7 Quality Assurance Provisions

All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 100 kpsi.

All optical fibers > 1000 meters shall be 100% attenuation tested. The attenuation of each fiber at both operational windows shall be provided with each cable reel.

The cable manufacturer shall be ISO 9001 registered.

FOC - 1.8 Packaging

Top and bottom ends of the cable shall be available for testing.

Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each reel shall have a weatherproof reel tag attached identifying the reel and cable.

FOC - 1.9 Pre-Terminated Drop Cable Assemblies

These assemblies shall be employed when connecting a camera, controller, VMS or other device to the trunk cable and mid-span splice techniques will be used.

Cable used for Drop cable assemblies shall conform to section FOC – 1.5.

FOC - 1.10 System configuration

Drop & Insert Applications

Signal from the TOC to local controllers, Cameras, and/or Variable Message Signs will be conveyed via the trunk & drop cables in a closed loop configuration. At each controller, the applicable fibers will be routed in & out of the applicable housing using a Gator Patch and a mid-span access splice point. Only fibers required for the drop & insert shall be cut, no other fibers in the cable shall be cut without the direction of the engineer.

The length of the drop cable shall be determined by the contractor after the traffic signal cabinet, pull boxes, and conduit has been installed to insure proper sizing. Twenty feet (20) of drop cable shall be coiled neatly in the pull box with the splice enclosure to provide slack.

Fiber Optic Communications

Transceivers for CCTV
A transmitter unit to be located in the CCTV cabinet shall be an approved equivalent of the GE Security S7730DVT-EFC1 (FC connector)

A receiver unit to be located in the TOC shall be an approved equivalent of the GE Security S7730DVR-RFC1 (FC Connector)

FOC - 1.11 Fiber Optic Patch Cables (Jumpers)

Any patch cords used for system configuration shall be compatible with fiber types and connectors specified herein. Single-mode patch cords shall be yellow in color and each jacketing material shall conform to the appropriate NEC requirement for the environment in which installed. All cordage shall incorporate a 900um buffered fiber, aramid yarn strength members, and an outer jacket. Patch cords may be simplex or duplex, depending on the application. Single-mode fibers shall be 1.0dB/km @ 1310nm, 0.75dB/km @ 1550.

FOC - 1.12 Fiber Optic Connectors

All connectors used in the communication system shall be FC compatible, ceramic ferrule connectors. Factory terminated connectors shall be heat cured epoxy type with a maximum measured loss of $\leq$ 0.30 dB; No field installable connectors accepted. The operating temperature of all connectors in the system shall be - 40C to $\pm$70C with no more than a 0.20dB change across the temperature range.

FOC - 1.13 Fiber Optic Closures

Aerial, Pole Mount, Pedestal, and Hand Hole Environments. OSP Closure for Aerial, Pole Mount, Pedestal, and Hand Hole will incorporate the following features:

The closure shall be capable of accepting up to six cables in a butt splice.

The closure shall be capable of storing up to 90" lengths of expressed buffer tubes.

Assembly shall be accomplished without power supplies, torches, drill kits or any special tools. Reentry shall require no additional materials. Sealing shall be accomplished by enclosing the splices in a polypropylene dome that is clamped together with a stainless steel latch and sealed with an O-ring.

Closure shall be capable of strand mounting with the addition of a strand mounting bracket.

Splice case shall be non-filled (no encapsulate), will prevent water intrusion and shall allow re-entry without any special tools. The closure shall be capable of preventing a 3 meter (10 foot) water head from intruding into the splice compartment for a period of 7 days. Testing of the closure is to be accomplished by the placing of the closure into a pressure vessel and filling the vessel with tap water to cover the closure. Apply continuous pressure to the vessel to maintain a hydrostatic head equivalent to 3 meters on the closure and cable. This process shall be continued for 7 days. Remove the closure, open to check for the presence of water. Any intrusion of water in the compartment containing the splices constitutes a failure. It is the responsibility of the Contractor to insure that the water immersion test has been performed by the manufacturer or an independent testing laboratory, and the appropriate documentation has been submitted to the city.

Buried-OSP Closure for buried applications will incorporate the following features:

Splice case must handle up to four cables. A butt adapter, if applicable could be used to increase capacity to eight cables.

Splice case shall be non-filled (no encapsulate), will prevent water intrusion and shall allow re-entry without any special tools. The closure shall be capable of preventing a 3 meter (10 foot) water head from intruding into the splice compartment for a period of 7 days. Testing of the closure is to be accomplished by the placing of the closure into a pressure vessel and filling the vessel with tap water to cover the closure. Apply continuous pressure to the vessel to maintain a hydrostatic head equivalent to 3 meters on the closure and cable. This process shall be continued for 7 days. Remove the closure, open to check for the presence of water. Any intrusion of water in the compartment containing the splices constitutes a

failure. It is the responsibility of the Contractor to insure that the water immersion test has been performed by the manufacturer or an independent testing laboratory, and the appropriate documentation has been submitted to the city.

The closure shall be capable of accommodating splice organizers which accept mechanical, single fiber fusion, or multi fiber splices. The closure shall have provisions for storing fiber splices and unspliced fiber/buffer tubes. The closure shall hold a minimum or 2 splice trays to a maximum of 15 splice trays with each tray housing up to 24 splices. The closure shall be UL rated.

Closure re-entry and subsequent reassembly shall not require specialized tools or equipment.

For compression testing, the closure shall not deform more than 10% in its largest cross-sectional dimension when subjected to a uniformly distributed load of 1760 Newtons at -18degreeC and $\pm$38degreeC. The test shall be performed after stabilizing at the required temperature for a minimum of two hours. It shall consist of placing an assembled closure between two flat parallel surfaces, with the longest, closure dimension parallel to the surfaces. The weight shall be placed on the upper surface for minimum of 15 minutes. The measurement shall then be taken with the weight in place. It is the responsibility of the Contractor to insure that the compression test has been performed by the manufacturer or an independent testing laboratory, and the appropriate documentation has been submitted to the city.

FOC - 1.14 Fiber Optic Termination Hardware

For cross connect applications inside controller cabinets, the fiber optic cable shall be terminated using a 900µm fan-out modular design for the fiber count being terminated. The nonmetallic fan-out shall attach directly to the buffer tube and transition the 250µm coated fibers into the fan-out tubing. The fan-out shall be housed in a Wall Mount Distribution cabinet equipped with the appropriate number of adapters. The fibers shall be connected to the transmission equipment via FC/FC fiber optic patch cables. This hardware scheme shall also be utilized for wall mount applications.

For rack mount applications, the fiber optic cable shall be terminated using a 900µm fan-out modular design for the fiber count being terminated. The non-metallic fan-out shall attach directly to the buffer tube and transition the 250µm coated fibers into the fan-out tubing. The fan outs shall be housed in a Fiber Distribution Center sized for 50% growth based on the initial installation. Appropriate panels for FC adapters shall be included based on the population of the fiber cable installed. If fusion or mechanical pigtail splicing is used for

termination points, a splice housing with appropriate 900um pigtails and splice trays shall be used in conjunction with the Fiber Distribution Center.

FOC - 1.15 Installation

Aerial Installations

All fiber optic components will be installed in accordance with the manufacturer's instructions. All necessary interconnections, services, and adjustments required for a complete and operable data transmission system shall be provided. All pole attachments, service loops, and conduit risers will be placed to minimize the possibility of damage as well as to facilitate future expansion or modernization.

Cable between controllers shall be lashed to a 1/4" EHS messenger with stainless steel lashing wire for aerial installations. The installation will be accomplished in accordance with accepted OSP construction practices. Precautions shall be taken to insure the installation specifications for the cable are not exceeded (tension, minimum bend radius). The cable shall be marked with an orange weatherproof identifying tag at each pole location, with print "Caution, Fiber optic Cable"

The cable shall be installed in continuous runs as indicated on the plans. Splices shall be allowed only at drop points and only those fibers necessary to complete the communication path shall be spliced (mid-span access). All other fibers in the cable(s) shall be left undisturbed; with a minimum of 5 feet of buffer tube coiled inside the closure.

Sufficient slack shall be left at each drop point to enable access of the cable components and splicing to occur on the ground (typical 2 x strand height plus 15 ft) (60 feet). For aerial slack storage at splice points, a radius controlling device, commonly referred to as a SNO-SHOE shall be used for securing resulting cable slack at aerial splice points and shall be mounted directly to the strand.

For aerial cable runs exceeding 6 pole spans between splice points (indicated on the plans), two opposing SNO-SHOES shall be placed on the span 50' apart to provide for a 100' service loop for future drops and for slack for repair and pole relocations.

Underground Installations

Install fiber-optic cable underground in conduit using cable pulling lubricants approved by the fiber-optic cable manufacturer and the Engineer.

Obtain approval of cable pulling lubricant and method of pulling before installing underground fiber-optic cable.

Use a dynamometer (clutch device) so as not to exceed the maximum allowable pulling tension if the cable is pulled by mechanical means. Do not use a motorized vehicle to generate cable pulling forces.

Keep tension on the cable reel and pulling line at the start of each pull. Do not release tension if the pulling operation is halted. Restart the pulling operation by gradually increasing tension until the cable is in motion.

For pulling cable through manholes, junction boxes, and vaults. Feed the cable by manually rotating the reel. Do not pull cable through intermediate junction boxes, handholes, or openings in conduit unless otherwise approved.

For underground installations, the following minimum slack requirements apply, 50 feet at the pull box locations or controller location for midspans, 15' for point to point applications for each cable.

Install communications cable identification markers on each communications cable entering a junction box.

Drop Cable shall be routed to the controller cabinets via conduit risers or underground conduit as illustrated in the plans. The cable entrance shall be sealed to prevent water ingress.

The minimum requirement for fiber protection outside a fiber optic enclosure in ALL cases shall be 3.0mm Fan-out tubing, containing a hollow 900um tube, aramid strength members and an outer jacket, and shall be secured to the cable sheath.

The minimum requirement for fiber protection inside wall mount or rack mount fiber enclosure shall be 900um buffering, intrinsic to the cable in the case of tight buffered fibers, or in the case of 250um coated fibers, a fan-out body & 900um tubing secured to the buffer tube(s).

FOC - 1.16 Testing and Documentation

OTDR TESTING

Prior to the installation, the contractor shall perform on-site on the reel testing. The contractor is required to test all fibers in each reel of cable prior to installation. This testing is for both continuity and attenuation. The tests shall be conducted at 1310nm for single mode fibers. The testing shall be performed using an Optical Time Domain Reflectometer (OTDR) via a "pigtail" splice. The

resultant OTDR trace(s) shall reflect overall length and attenuation expressed in db/km. All test results shall be within ±3.0% of factory supplied attenuation measurements for single mode fibers. Testing shall be done in one direction only. Hard copy or disk based (with applicable software) OTDR traces for the testing shall be supplied to the City by the contractor prior to installation of cables. The contractor may opt to accept factory results and install cable at his own risk. In either case, On-the-reel test results or factory measurements shall be provided to the city for each cable installed.

Following installation, each section of the installed cable shall be tested for continuity and attenuation as indicated above. The traces shall demonstrate that no change in transmission characteristics has occurred during installation and that any splices meet the requirements herein. This testing can be done in conjunction with the ETE testing described below. The traces shall be included in the documentation package provided at the conclusion of the contract.

ATTENUATION TESTING

Only connectorized spans will be tested for final End-to-End attenuation (power loss). The testing shall be performed at 1310 nm and 1550 nm for single-mode fibers. The testing shall be conducted using "hand-held" optical test sets and shall be conducted using a two jumper reference. The testing shall be in one direction only. The results shall be tabulated and be included in the documentation package provided at the conclusion of the contract. Overall loss for each link shall not exceed the cumulative specified losses of the components in the link.(EXAMPLE, @850nm, a 1 km link with 2 splices and a connector on each end shall not exceed:

5.0dB((3.5dB±.25dB±.25dB±.5dB±.5dB))

TESTING OF CONTINUOUS FIBER OPTIC CABLE

The fibers in this installation shall be tested for final End-To-End attenuation (power loss). The overall loss for this link shall not exceed the manufacturer’s specifications. The fibers are being installed for future use when demanded and must be operable at this time.

At the conclusion of the contract, 2 copies of system documentation package shall be provided. It shall include at a minimum:

A. Post installation OTDR traces for each fiber.
B. End-to-End Attenuation measurement for each fiber.
C. A splice plan showing the location and configuration of any splices in the system as well as how the transmission scheme is set up.
D. Reference manuals for equipment provided.

ITS DEVICE CONTROL CABINET

ITS - CAB - 1.0 Description.

All construction, materials, equipment, workmanship and installation procedures shall comply with the T.D.O.T. Standard Specifications for Road and Bridge Construction, March 1, 2006 (as amended) Section 730.01 et al, and with these current standards and specifications of the City of Franklin.

ITS - CAB - 1.1 Materials.

Material, equipment, and hardware furnished under this section must be pre-approved by the Engineer.

The contractor shall provide a Type B Model 336A cabinet specifically wired for either CCTV, DMS, WMS or PCS, dependent on the application for the installation.

ITS - CAB - 1.2 Functional Requirements

The cabinets shall be provided with fully wired back and side panels with all necessary terminal boards, wiring harnesses, connectors and attachment hardware for each cabinet location. All equipment shall be shelf mounted. All terminals and panel facilities shall be placed on the lower portion of the cabinet walls below the shelves.

The Contractor shall submit a cabinet layout for each installation for review by the Engineer. Only cabinets with approved layouts will be accepted by the City of Franklin. Each field cabinet shall, as a minimum, be supplied with the following:

- Fan and Thermostat
- Left Side Power Distribution Panel
- Air Filter
- Adjustable Shelves (1-4 as required)
- Back Panel
- Right Side Panel
- Locking Mechanism
- Lock
- Ground Bus (2)
- Surge Protection (for Solid State Equipment)
- Terminal Blocks
- Duplex Power Outlets (GFI protected)
- Drawer that opens and slides out for placement of notebook computer
- All necessary installation and mounting hardware.

a. ITS – CAB – CCTV Cabinet

The contractor shall provide and install all equipment, hardware and software to provide for functional camera installation. The camera installation shall provide an operating camera with equipment ready for future fiber optic communications with the City of Franklin's Transportation Operations Center. The equipment consists of a transmitter in the cabinet (General Electric Co.; Model # S7730DVT-EFCI) and the accompanying receiver for the Transportation Operations Center (General Electric Co.; Model # SS7730DVR-RFCI).

ITS - CAB - 1.3 Construction Methods.

The contractor shall install the CCTV pole standard per the T.D.O.T. Standard Specifications, and pole manufacturer's design standards.

The cabinet will be secured using steel banding.

The pole base will provide three (3) 2-inch, non-metallic (High Impact Schedule 80 PVC) conduits into the interior of the pole. One of the conduits will contain the metered power service lines. One conduit will contain the communications cable (Fiber optic or hardwire). The remaining conduit will be a spare with a pull rope installed between the main pull box and the pole foundation.

One 2-inch conduit nipple will connect the cabinet with the interior of the pole.

Metered power leads, data cables and communications cables shall be run on the interior of the pole.

Handholes shall be provided near the base of poles and near the device location for access to install and maintain the data leads. Strain relief J-hooks will be provided on the interior of the pole at the device location handhole.

Cabinet shall be mounted 48" above finish grade.

ITS - CAB - 1.4 Method of Measurement.

In accordance with the T.D.O.T. Standard Section 730 et al.

CCTV, POLE & LOWERING DEVICE

CCTV - 1.0 Description.

All construction, materials, equipment, workmanship and installation procedures shall comply with the T.D.O.T. Standard Specifications for Road and Bridge Construction, March 1, 2006 (as amended) Section 730.01 et al, and with these current standards and specifications of the City of Franklin.

CCTV - 1.1 Materials.

Material, equipment, and hardware furnished under this section must be pre-approved by the Engineer.

The contractor shall provide a CCTV PTZ camera, control and communications hardware and enclosure, pressurized dome housing and mounting apparatus equivalent to the Vicon Dome Camera (Model # SVFT-PRS35). The contractor shall pressurize the camera dome and provide the City of Franklin a certification document warranting that work.

In addition, the contractor shall provide a galvanized metal pole standard with a length of fifty (50) feet. The pole standard shall be designed according to AASHTO Standards and Specifications For Structural Supports For Highway Signs, Luminaires, and Traffic Signals (Current Edition, et al). The pole standards shall be designed for a wind velocity of ninety (90) miles per hour. The steel support shall be finished by the manufacturer in a black gloss color and shall be touched up as needed by the contractor.

The contractor shall also provide a lowering device compatible with the existing City of Franklin Vicon Surveyor VFT series equipment.

Camera Lowering Device Requirements for 50’ poles

Basic Configuration

The work under this item specifies the additional requirements for the 50 foot poles which should be equipped with the Camera Lowering Device (CLD). The Camera Lowering Device shall be safely operable by one trained technician working alone, to lower the Camera Assembly to ground level for maintenance as necessary and return the Camera Assembly to the pole top mounting and secure it in place, eliminating the need for access by a bucket truck. The camera lowering device shall be installed at camera sites as indicated on the plans. Weatherproof connectors (camera to the lowering device) shall allow for adaptation of the camera and the dome type housing for lowering and hoisting. Lifting and lowering shall be done with a motorized gear box (winch). The CLD should be a stand-alone device mounted on a camera pole to be supplied by the Contractor and included in the cost of the 50’ pole. An integrated CLD with pole assembly may be procured provided it meets all specifications.

General

The Contractor shall design the required pole mounting adapters, brackets and mounting hardware, including extensions and cable entry to the camera mounting pole to accommodate the dome enclosure with pan/tilt unit and pole combination. The pole mounting adapter shall be electrically bonded to the pole. The pan and tilt unit shall be electrically bonded to the mounting adapter. An individual Camera Lowering Device shall be furnished and installed at each CCTV site

designed to support and lower a standard closed circuit television camera, lens, housing, PT mechanism, cabling, connectors and other supporting field components without damage or causing degradation of camera operations. This Camera Lowering Device shall consist of an arm mounted suspension contact unit attached to the galvanized steel pole at locations as shown on the Plans. The Camera Lowering Device shall include a tracking guide system permitting the moveable portion of the system to align in the same position every time the system is operated thereby eliminating the need to re-orientate the camera. The electrical / signal connector shall mate without any degradation of performance due to vibration or movement during operation. The cables for the Camera Lowering Device shall not come into contact with any other cables inside the pole.

The entire device, complete with the camera, shall be tested by an independent laboratory experienced in structural, mechanical and electrical testing. It shall be shown to withstand wind forces of greater than 90 mph with a 1.3 gust factor. Certified and dated test reports from the testing facility shall be submitted to the Engineer within ten (10) days after the testing for review and approval.

All Contractor designs, testing results and shop drawings of the camera mounting, lowering device and structural design shall be in compliance with the Contract Documents and Plans and submitted to the Engineer for review and approval ninety (90) days after the Notice to Proceed. The Contractor shall arrange for a factory representative to assist the Contractor with the assembly and testing of the first Camera Lowering Device onto the pole assembly. Copies of written installation and operating instructions shall be furnished to the Engineer as required by the Contract Documents.

All external components of the Camera Lowering Device shall be made of corrosion resistant materials, anodized, galvanized, or otherwise protected from the environment and dissimilar metals by industry accepted coatings to withstand exposure to a corrosive environment. All pulleys for the camera lowering device and portable lowering tool shall have sealed, and self lubricated bearings. At the discretion of the Engineer, an integrated CLD with pole assembly may be procured.

Suspension Unit

The Contractor shall design the required pole mounting adapters, brackets and mounting hardware. The Camera Lowering Device shall have a minimum load capacity 200 pounds with a 10 to 1 safety factor. The enclosure receptacle and camera enclosure shall incorporate a mating device. The mating device shall have a minimum of 2 latching devices. These latching devices shall securely hold the camera housing and its control equipment free of vibration or motion between the enclosure receptacle and camera enclosure. The latching devices shall lock and unlock by alternately raising and lowering the camera enclosure. When the camera enclosure is latched, all weight shall be removed from the lowering cable.

The enclosure receptacle and camera enclosure shall have a heavy-duty tracking guide. The tracking guide and latching devices shall lock the camera enclosure in the same position each time.

Sufficient electrical contacts shall be provided to support all camera functions. The electrical contacts shall be gold coated to prevent corrosion. In addition, replaceable gaskets shall be provided to seal from moisture and dust the electrical contacts and latching devices.

The Camera Lowering Device shall be designed to preclude the lifting cable from contacting the power or video cabling. The only cable permitted to move within the pole or lowering device during lowering or raising shall be the stainless steel lowering cable. All other cables shall remain stable and secure during lowering and raising.

The Camera Lowering Device shall support the Camera Assembly a minimum of 20" from the pole. The Camera Lowering Device shall be designed to permit a ±3 degree of horizontal adjustment for leveling the dome enclosure. The lowering cable shall be a minimum 5/32" diameter stainless steel aircraft cable with a minimum breaking strength of 2400 pounds.

Weights and/or counterweights shall be provided as necessary to assure that the alignment pin and connectors are proper for the camera support to be raised into position without binding and that sufficient weight is present on the camera and it's control components that it can be lowered properly.

Portable Camera Lowering Device Tool

The Contractor shall furnish and test one Portable Lowering Tool capable of being operated by a hand winch and an electric drill motor, which is fully compatible with the Camera Lowering Device and the Steel Camera Pole and meets the following requirements:

- The Portable Lowering Tool shall be one recommended by the manufacturer of the Camera Lowering Device.
- The Portable Lowering Tool shall have a minimum load capacity of 200 pounds with a 10 to 1 safety factor.
- The tool shall consist of a lightweight metal frame and winch assembly with cable, a quick release cable connector, an adjustable safety clutch and a variable speed industrial duty electric drill motor.
- This tool shall be compatible with the hand hole of the pole and the Camera Lowering Device inside the hand hole.
- When attached to the hand hole, the tool will support itself and the load assuring lowering operations and provide a means to prevent freewheeling when loaded.
- The Portable Lowering Tool shall be delivered to the Engineer upon project completion.

- The Portable Lowering Tool shall have a reduction gear to reduce the manual effort required to operate the lifting mechanism.
- The Portable Lowering Tool shall be provided with an adapter for operating the lowering device by a portable drill using a clutch mechanism.
- The Portable Lowering Tool shall be equipped with a positive locking mechanism to secure the cable reel during raising and lowering operations.

CCTV - 1.2 Construction Methods.

The contractor shall install the CCTV pole standard per the T.D.O.T. Standard Specifications, and pole manufacturer's design standards.

The CCTV camera shall be installed per the Vicon Installation and Operation Manual, (Part # 8009-8134-00-00) in the "outdoor pendant" configuration.

The CCTV dome housing shall be installed per the Vicon Installation and Operation Manual, (Part # 8009-8004-03-00) in the "pipe mount" method.

The CCTV control and communications hardware and enclosure shall be wired and installed per the City of Franklin Standard Detail 27, and the Vicon Installation and Operations Manuals indicated above.

CCTV - 1.3 Method of Measurement.

In accordance with the T.D.O.T. Standard Section 730 et al.

DYNAMIC MESSAGE SIGNS

DMS - 1.0 Description.

The contractor shall provide and install Dynamic Message Signs (DMS). The signs shall be fabricated according to the City of Franklin standards for DMS.

DMS - 1.1 Materials.

Material, equipment, and hardware furnished under this section must be pre-approved by the Engineer.

DMS - 1.2 Construction Methods.

In accordance with the T.D.O.T. Standard Section 730 et al.

DMS - 1.3 Method of Measurement.

In accordance with the T.D.O.T. Standard Section 730 et al.

WEATHER MONITORING STATIONS

WMS - 1.0 Description.

The contractor shall provide and install Weather Monitoring Stations (WMS). The stations shall be fabricated according to the City of Franklin standards for WMS.

WMS - 1.1 Materials.

Material, equipment, and hardware furnished under this section must be pre-approved by the Engineer.

WMS - 1.2 Construction Methods.

In accordance with the T.D.O.T. Standard Section 730 et al.

WMS - 1.3 Method of Measurement.

In accordance with the T.D.O.T. Standard Section 730 et al.

PERMANENT COUNT STATIONS

PCS - 1.0 Description.

The contractor shall provide and install Permanent Count Stations (PCS). The stations shall be fabricated according to the City of Franklin standards for PCS.

PCS - 1.1 Materials.

Material, equipment, and hardware furnished under this section must be pre-approved by the Engineer.

PCS - 1.2 Construction Methods.

In accordance with the T.D.O.T. Standard Section 730 et al.

PCS - 1.3 Method of Measurement.

In accordance with the T.D.O.T. Standard Section 730 et al.